

# A New, Scalable and Robust Land Ice Dynamical Core Built for Advanced Analysis

## Problem

New climate models, like ACME, aiming to simulate the evolution of large ice sheets require scalable, robust, efficient, and accurate ice flow models with advanced analysis capabilities.

## Approach

Using a component-based approach with *Trilinos*, we have built *Albany/FELIX*, a new finite element, first-order (FO) Stokes solver for land ice. New contributions in addition to the model include:

- (1) New manufactured-solution-based test cases for 2D forms of the FO Stokes equations (top right)
- (2) Development of a homotopy continuation algorithm for robust nonlinear Newton solves (middle right)
- (3) Development of a new algebraic multilevel preconditioner for scalable linear solves (bottom right).

## Impact

New parallel, scalable and robust, first-order accurate ice flow model for unstructured grids, callable from MPAS-Land Ice and being coupled to ACME.

I. K. Tezaur, M. Perego, A.G. Salinger, R.S. Tuminaro, S.F. Price. *Albany/FELIX*: a parallel, scalable and robust finite element first-order Stokes approximation ice sheet solver built for advanced analysis. *Geosci. Model Dev.* 8 1-24, 2015.

